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Cover photo.

Western Hognose Snake (*Heterodon nasicus* Baird and Girard) from Manitoba. Note the upturned rostral (nose) scale used in burrowing and the keeled scales which feel rough to the touch.

The Horse

There was once a little animal no bigger than a fox,
And on five toes he scrambled over Tertiary rocks.
They called him Eohippus, and they called him very small,
And they thought him of no value when they thought of him at all.

Said the little Eohippus, I am going to be a horse!
And on my middle finger nails to run my earthly course!
I am going to have a flowing tail! I am going to have a mane!
And I am going to stand fourteen hands high on the Psychozooic plain!

Mrs. Stetson

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President's Message

Endangered Species of Animals

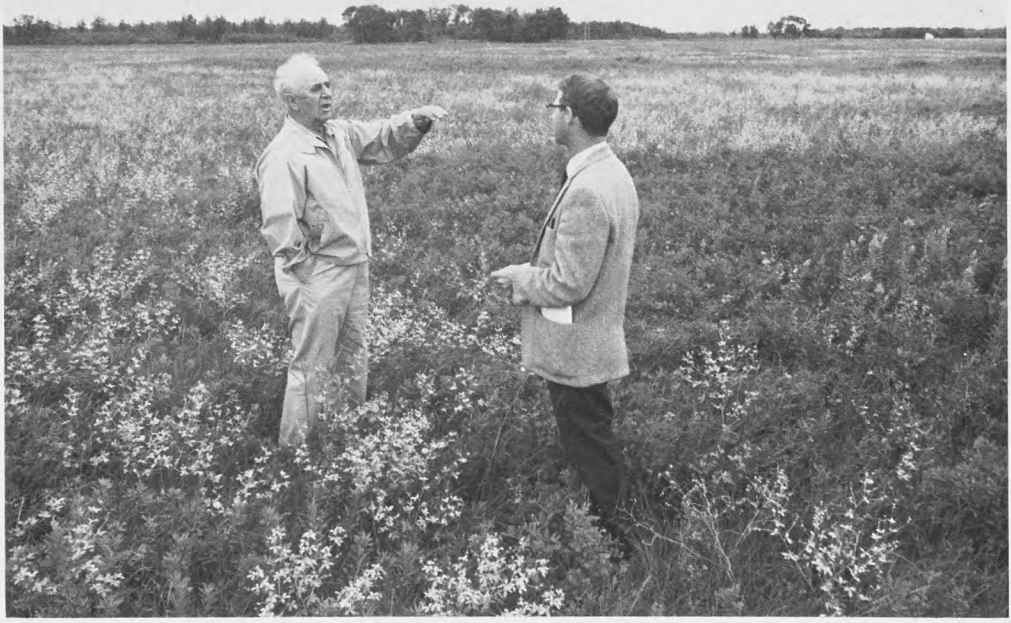
Society members are well aware of the continuous loss of animal and also plant species that occurs annually with the expansion of Man's activities and his dominance of the world. Indeed, zoologists have calculated that one kind of bird and of mammal has become extinct each year in this century. This shocking fact provokes much thought, discussion and action.

On one hand are those who would save these forms for their intrinsic value in the betterment and enrichment of future generations of Man. This argument is valid, though generally the species saved are those selected by Man for their colour, form, or habits. Efforts to save species of snakes on the brink of extinction are seldom as attractive as those to save beautiful birds like the Whooping Crane. Eventually, however, our choice of animal or plant may hinge on those which can contribute most to our own survival. On the other hand, students of evolution argue that extermination is just grist in the evolutionary mill. A species can no longer compete, or its habitat has become so diminished that its survival is no longer possible.

Study of species which have become extinct reveal that while Man's thoughtlessness or rapaciousness has contributed to the decrease of a species, it is usually a lack of knowledge of low numbers that has led to extinction. Where low numbers are known, then remedial measurements can be instituted, either by legislature or by management, with the consequence that the species often shows a dramatic increase in numbers. Extinction, then, arises more often from lack of knowledge, than from deliberate action.

Recently the Society was approached by the local representative of the International Biological Programme and asked to submit a list of animal species which the Society considers to be endangered in Manitoba or Western Canada. This will assist I.B.P. in drafting a resolution regarding the conservation of native fauna and flora. Hopefully this will lead to protective legislation. Mr. G. W. Malaher, our Vice-President, has agreed to organize a survey of members to determine their opinions on endangered species within the province. A questionnaire will probably be sent out. In the meanwhile members should write or contact Mr. G. W. Malaher at 151 Baltimore Road, Winnipeg 13. Any information will assist in awareness of threatened species.

H. E. Welch,
President.



Robert R. Taylor

St. James Prairie, Ed Russenholt and R. W. Nero.

The St. James-Assiniboia Living Prairie

Karen Johnson
Department of Botany
University of Manitoba

When the International Biological Programme, (IBP), Conservation Section in Manitoba started its work on the inventory and setting aside of representative examples of major ecosystems in Manitoba — deciduous and coniferous forest, tundra, grasslands, etc., it decided that grasslands, especially the true or tall grass prairie, were in the greatest danger and should therefore receive first attention. Tall grass prairie once occupied almost all of the Red River Valley and adjacent uplands south of Winnipeg, but has almost completely disappeared due to pressures from agricultural and other development.

More than sixty different prairie sites were suggested to the IBP by weed supervisors, agricultural representatives, and many others. All of these were examined during the summer of 1968 by a team of botanists organized by Dr. J. M. Walker of the University of Manitoba, and financed by the IBP. The team travelled over 5,000 miles in southern Manitoba to examine all of the suggested sites. Many of the sixty had been destroyed and only twelve were of the tall grass prairie type. Of the twelve sites, only four were basically undisturbed, and the best of the four turned out to be an area in St. James between Daisy Rd. and Harcourt St. on Ness Ave. The site (approximately 100 acres in size) had been known to local naturalists for many years, but it had always been assumed that hundreds of acres of this type of grassland still existed somewhere in the province. At the present time, the St. James site is one of only two known sizeable tracts of native tall grass prairie left in the whole of the Red River Valley, and one of the few remaining in all of North America.

True tall grass prairie is a type of vegetation found in the transitional zone between the drought-and temperature-controlled short grass prairie to the west, and the deciduous forest to the east. There is enough moisture available in this zone to support both the larger grasses (hence the name of the ecosystem) and some species of trees. However, periodic droughts and fires occur in the region, restricting

trees to low areas where water can accumulate, and to stream and river banks. Because of the abundant moisture available, Big Bluestem *(Andropogon gerardi)* and Indian Grass *(Sorghastrum nutans)* reach heights of eight feet in the south, and Little Bluestem *(Andropogon scoparius)* and Switchgrass *(Panicum virgatum)* reach five to six feet. Here in Manitoba, where the climate is colder, Big Bluestem and Indian Grass range from three to seven feet in height, while Little Bluestem reaches only two feet.

These tall grasses, growing in bunches with other plants such as sunflowers *(Helianthus* sp.*)*, coneflowers *(Ratiba* sp.*)*, and wild indigo *(Amorpha* sp. *)* growing in between, form a dense, and at times almost impenetrable wall of plants, which may reach eight feet in height in a good prairie. The rich bluish-purple colour of the Bluestems lends a subtle but beautiful colour to the prairie in the fall and winter, with bright sunflowers, goldenrods *(Solidago* sp.), and blazing stars (*Liatris* sp.), adding accents in the autumn. The Prairie Crocus *(Pulsatilla ludoviciana)* is greeted as a sure sign of spring, and the later anemones and Three-flowered Avens *(Geum triflorum)* lend more colour with the spring green of the grasses.

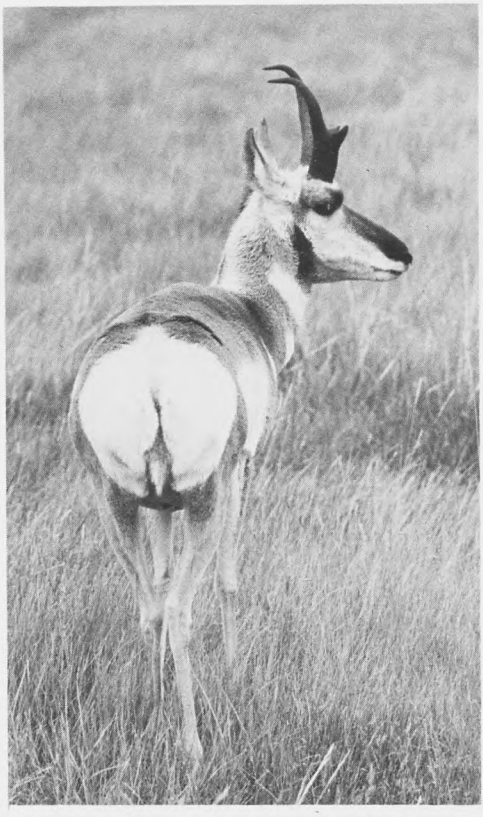
The major importance of the St. James site is the fact that the soil has never been severely disturbed. From half an inch below the surface, to a depth of three to six inches, the soil in the true prairie is occupied by roots, rhizomes, bulbs, corms, and their outgrowths. A fine network of roots extends several feet in depth forming a dense sod. It is this tremendously rich, deep soil that has made the prairie provinces the "Breadbasket" of Canada. This soil has been produced by over 10,000 years of interaction between climatic factors such as rainfall and temperature, parent material such as glacial drift or lake bed sediments, and biological organisms such as the prairie grasses, soil bacteria and fungi. Once this highly structured soil has been disturbed by plowing or bulldozing, it is difficult if not impossible to restore the original vegetation on the site. It has taken over twenty years to restore a ploughed field to a reasonable facsimile of tall grass prairie in Illinois, and many attempts have ended in failure.

Preservation of the site was thus recommended to the St. James City Council (since the City of St. James owns the land) by the IBP and a wide variety of interested individuals and organizations in 1968. The City Council agreed, in principle, to set aside not more than twenty five acres of the site for a prairie park, but did not pass legislation confirming the boundaries of the site. The high potential value of the land for development posed serious threats to the site, and it became necessary for the IBP to reaffirm its value in the fall of 1969. At present about fifty acres of the site (including a good burr oak woodlot) are being preserved as a Centennial Project by St. James-Assiniboia, and will be known as the St. James-Assiniboia Living Prairie Museum. The rest of the site, north of the proposed beltway, will be lost to industrial development under present plans.

Final boundaries on the site are being negotiated with the Technical Vocational High School which will be built immediately adjacent to the prairie. The site will be burned early in the spring to eliminate invading annual grasses and woody shrubs. A landscape architect had been retained by the Parks Board, and he, the architect for the school, and the IBP are working closely together to minimize problems incurred by drainage changes caused by the construction of the school. A surrounding hedge of aspen and native shrubs, a small interpretive centre, and minimal system of paths are planned for the site at present. If the prairie museum develops as planned, the living museum concept may prove to be a very valuable educational and scientific tool for the entire province. It would be fairly simple at the present time to develop a series of such living museums within Metro Winnipeg, which would represent major ecosystems present within the province on a small scale.

Robert R. Taylor

Rebirth of a Museum



Robert R. Taylor

When the Manitoba Museum of Man and Nature opens its doors to the public on July 15, 1970, a new era in Natural Science in Manitoba will have begun. Museums are traditionally places that stimulate an interest in nature and man; many a professional scientist or lay scholar professing an early inspiration through contact with some museum. In Manitoba, interested naturalists began stimulating interest in a museum more than 70 years ago. The Reverend W. A. Burman, President of the Historical and Scientific Society of Manitoba, speaking to the Annual Meeting on July 14, 1900, stated:

> "It is little less than criminal to allow a Province which has reached such a stage as we have in Manitoba, to go on without a museum belonging to the people, in which may be stored, and safely preserved, valuable specimens and literature, bearing on both the natural history and ethnology of this Province."

The efforts of Reverend Burman and others were partly realized in 1932 when, through the Manitoba Museum Association, a museum was established. "For 33 years, in spite of unrealistic budgets, limited facilities and an almost inaccessible location, the Association managed to maintain a small but scien-

tifically sound museum." That quotation, from a recent annual report of the Manitoba Museum of Man and Nature, is a salute to the museum in the Winnipeg Auditorium and to the many persons who kept it running for all these years. It is now in its demise. Many of the exhibits have been dismantled and it is only a matter of weeks before all signs of a museum in that location will have disappeared. No doubt, many a person will continue to trudge up to the third floor to enquire for Dick Sutton, only to be told that he now holds forth in the Manitoba Museum of Man and Nature, at the Centennial Centre on Main Street.

The splendid furnishings of the new Concert Hall and Planetarium (a division of the Museum) are no indication of the crowded quarters in the old police garage behind the Centennial Centre in which Director Jack Herbert and his staff have been operating for the past three years. It was here that the Planetarium was designed, and it is here that plans for the rest of the Museum complex were made. Staff still occupy this building, along with thousands of artifacts of natural and human origin, including much material accumulated over the past years by the old museum. Recent accessions include pre-Eskimo culture artifacts, discovered in subarctic Manitoba only last year, and Ukrainian household goods from past decades; Plains Indian clothing and "medicine bundles", and extinct buffalo bones from a recent sewer excavation beneath Winnipeg streets.

But don't go rushing down to look at these things — chances are the busy curators won't be able to take time to show you their wares. Everyone is busy working towards the deadline of July 15, 1970, when the first exhibits will be opened to the public. The staff is also preparing for an impending move — literally lock-stock-and-barrel, for in mid-March the new museum building should be ready for occupancy. The Exhibition Hall has been completed for some time, and numerous employees are presently engaged there in setting up exhibits. We understand that an "Orientation Gallery" and a portion of a "Grassland Gallery" will be completed in time for the grand opening. How this has been accomplished, considering that the Exhibition Hall was not made available until last year, is a matter of conjecture. Obviously, people have been busy. It will be interesting to see to what extent the exhibits accomplish the stated objective of helping people to appreciate the complex interrelationships between man and his environment.

In spite of the fact that the Museum **building** is not yet available to staff, it is clear that the Museum is already in operation. Research programs have been undertaken in ornithology, paleontology, archaeology and history, thus proving the old adage that it is the **staff** that makes the museum. Museum staff has occasionally been exposed to the public eye through lectures and news releases, but its activities are not well known to most of us. Hopefully, once the new building is occupied, and once staff have had time to get things in place, it should be possible to get a clearer picture of what the Museum will include by way of programmes, resources and facilities. We do know that a competent staff is being assembled. Dick Sutton is head of a Division of Interpretation (including a staff of photographers, artists, designers, and various technical people); Bob Nero is head of the Division of Natural History (with Curators in Botany, Paleontology, and more to come); and Richard Conn is or was, head of the Division of Human History (with Curators in History, Ethnology, and Archaeology). We have recently learned that Mr. Conn has resigned to take a position as Director of the Heard Museum of Anthropology in Phoenix, Arizona. We regard this as a great loss to the Museum and to Manitoba. The head of the Planetarium Division, Dennis Gallagher, has had a swinging programme going for some time now, and we can only wish the other Museum divisions equal success in their endeavours.

Author's name withheld by request

Harold Hosford

It's Still Cold Outside

There's a cold-wave warning. You check your home thermostat; set it to compensate for the dropping temperatures; see that your oil tank has the reserves to take care of the coming onslaught, plug in the car and settle back to let winter do its worst.

That's how one North American species adapts to winter. Others fly south, the smart ones; some just hole up and sleep the winter away and still others go whole-hog and hibernate, completely indifferent to the icy blasts around them. But then there are those that just stick it out, in most cases wonderfully adapted to the struggle for survival in winter.

Despite appearances, the urban sprawl of a large city like Winnipeg, and the heavily developed agricultural areas which surround it, are not a wildlife barren grounds in winter. For those who

can see the signs are everywhere that life in the wild goes on, and it goes on in wondrous variety.

It may come as a surprise that such large and conspicuous animals as White-tailed Deer are fairly common in the woodland areas around the city and even in some favoured woods well within the built-up area. But the White-tail shouldn't be classed as one of the species "wonderfully adapted" for the struggle against our winters. They're relative newcomers to this part of North America, having come with agriculture. Their ancestral home, farther east and south does not have winters as long or severe as the Canadian plains. A severe Manitoba winter can decimate deer populations almost overnight.

Severe cold seems to numb their senses and even rob them of the normal desire to eat, even when food is readily available. Add deep snow, restricting the movements of the animals, and you have the makings of a wildlife disaster.

But the deer have one thing in their favour and so far it's been enough to make them a success in their new environment: that one factor is fecundity. (See Zoolog Volume 7, Number 4, December 1966, "Deer Through The Winter"). They have the reproductive capacity to recover rapidly from a severe winter, almost as rapidly as the winter reduced their numbers. It is only when a succession of severe winters occurs that deer populations will decline.

Turning from a comparative newcomer to the long-time residents, we do find animals that know how to handle winters very well. Oh sure, Jack Frost takes his toll even among these hardy species but thousands of years of evolution and competition have given them a few advantages that help them cope with winter weather; the well-known feathered feet of the Sharp-tailed Grouse, the snow-shoes of the Ruffed Grouse, the winter white of the Snowshoe Hare and the weasels, all species found around Winnipeg in winter.

All these animals leave the tell-tale signs of their presence in the snow. But under the snow there are other animals, equally active, that often leave little trace of their passing and which might go unnoticed to all but the most experienced observer. Shrews of several species, along with meadow mice and voles in abundance, live most of their winter lives in a maze of tunnels under the snow well insulated from the deep freeze above them. The only signs of their work are the occasional breathing or ventilation holes poked through the snow and short trails of tiny footprints where an unwary mouse struck out over the no-mans-land of snow momentarily facing the peril of predatory birds and mammals.

Two other permanent residents of our woods have interesting ways of coping with the winter. One, the familiar Red Squirrel, does all the right things. He stores food, snoozes through the worst of the cold, builds warm leaf nests or lives in the comfort of a hole in a tree, and is ever on the alert for danger. No wonder he's a success.

The other, a little brown fellow, also a newcomer to these parts, the Nebraska Cottontail Rabbit seems to do all the wrong things. Yet, he's a success too. Unlike the Snowshoe Hare, the Cottontail remains brown all winter and is as conspicuous against the white snow as a football. But the Cottontail's secret of success seems to be an ability to make himself inconspicuous despite the disadvantage of his coat, his superb ability to outmaneuver almost any predator that gets on his trail and most important, like the White-tailed Deer, he is a reproducer. As a matter of fact these little fellows might have been the basis for the well-known stories of the reproductive capacity of rabbits. At any rate, in spite of all the privations of winter, spring finds the little Cottontail busily reproducing to make up the losses.

These are only a few of the wild animals that share the urban and rural wilderness with Homo sapiens. They've got what it takes to make the grade against winter. One of these days, when it warms up a bit, you might go out and take a look for them.

Harold Hosford

Figure 1.
A large terrarium for amphibians based on a ten gallon aquarium (Designed by R. W. Hancox).

Terraria For Amphibians And Reptiles

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Department of Zoology
University of Manitoba

A terrarium is the terrestrial equivalent of the fish fancier's aquarium. Basically, it consists of a closed container in which a suitable environment can be maintained for small animals. The animals kept may range from insects, such as ant or termite colonies, to small mammals, such as rodents or shrews. Among the vertebrate animals, the amphibians and reptiles make the most suitable terrarium specimens.

A terrarium, whether it is fashioned from an existing container or built to specifications must take the requirements of the animals to be kept into account.

First, a terrarium should be **secure.** With the exception of turtles, amphibians and reptiles have a phenominal ability to squeeze through small openings. If the terrarium is to be displayed, the lid should be locked. All ventilation ports should be covered with screen.

Second, the **substrate** should be easy to keep clean and should not be injurious to the animal. Avoid coarse, angular sand such as that supplied for tropical fish aquaria. Fine silica sand or silica and limestone sand such as can be found along any roadside in the Sandilands area of Eastern Manitoba, or on the beaches of Lakes Winnipeg or Manitoba is best. The fine grains will not injure your animals, and solid wastes are easily removed with a small tea strainer. Soil is not recommended, since animal wastes will be absorbed by it.

Third, **space** should be adequate for the species being kept. In general, all amphibians and reptiles do better as the space available to them is increased. I would not recommend any container with a bottom area of less than eight by ten inches, even for the smallest frogs and salamanders. If the animal climbs, as do Tree Frogs and some lizards and snakes, vertical space should be allowed for this. You should try to have at least six inches above the surface of the substrate in even the smallest terraria. On the other hand, terraria need not be excessively large. Our largest terraria at the University measure eighteen by twenty four inches and twenty four inches high. We have held snakes up to five feet long in these for three years and they remain as active and healthy as they were when captured.

Other requirements are more specific for the animals being kept. All amphibians require a humid environment, and some, such as Leopard Frogs and Tiger Salamanders, should have enough stand-

ing water to swim in. Glass terraria, modified from aquaria or battery jars are best for amphibians, since they hold moisture without damage, and can hold standing water as well. Figure 1 shows a terrarium for Tree Frogs and Blue-spotted Salamanders. In this case, the only modification to the ten gallon aquarium was to fit it with a "frog-proof" expanded metal lid. Fine gravel was piled above water level for the dry end, and flat pieces of limestone were used to prevent the sand from sliding into the "pond" on the right. The standing water keeps the sand and the air in the terrarium moist. Figure 2 shows a small terrarium for Chorus Frogs and Spring Peepers which was constructed from two plastic refrigerator boxes. The plastic freezer carton on top contains a fruit fly cutlure. A plastic tube running down into the terrarium from the top of the culture medium allows adult flies to get into the terrarium, where they are eaten by the frogs. A new fruit fly culture can be put in place as the one in use becomes exhausted. The amphibian terraria shown in Figures 1 and 2 were designed and built by Mr. R. W. Hancox of the Department of Zoology, University of Manitoba, and additional information can be obtained by writing him at the University.

The requirements of reptiles in captivity are more varied than those of amphibians. Some reptiles, such as crocodilians and some of the turtles, require access to standing water that they can submerge in. Others such as many of the lizards, some snakes and some turtles require no free water at all, and may get skin ailments if they cannot keep dry. Since two reptiles belonging to the same group may have vastly different water requirements, you should identify your specimen and find out all you can about its natural habitat in order to keep it properly. Often, dealers can supply this information. If you collect your own specimens, you should keep records of the habitats in which you found them and try to duplicate these in the terrarium.

Figure 3 shows a terrarium constructed of plywood with a glass front that we use tc house reptiles at the University. Although some reptiles require standing water, none have the requirement for humid air that is universal among amphibians. Reptile terraria should have larger ventilation ports and should always have an area of dry substrate large enough to allow the specimen freedom to move without getting wet. We supply water in plastic bowls imbedded in the substrate. When lizards or snakes are being kept, a few stones, pieces of driftwood, or artificial plants are supplied. These provide concealment and a surface that the specimen can rub its skin on to assist in moulting. In addition, they provide decoration that makes the display attractive and natural-looking.

Another requirement of all reptiles is warm temperature. In all cases a reptile terrarium should be kept at between 75 degrees and 85 degrees F. Reptiles become inactive and refuse to feed at cooler temperatures, and may be killed by excessive heat if the temperature is higher than 85 degrees F. We use 60 watt incandescent lamps to warm our 18 x 24 x 24 inch terraria, and correspondingly smaller bulbs for smaller

Figure 2.

A small terrarium for amphibians or reptiles made from two refrigerator boxes hinged together. Dimensions are about eight by ten inches by eight inches high. (Designed by R. W. Hancox).

Figure 3.

A large reptile terrarium with glass front and screened ventilation ports. Doors are opened to illustrate construction.

terraria. Again, the provision of cover is important, since a reptile will keep its body temperature at an even, preferred level if it is allowed to gain heat by basking and take shelter in shade when it has warmed up. At normal room temperature, the light need not be left on all night. In nature, most reptiles cool down and become inactive after dark, so switching off the light at night only duplicates natural conditions.

Food Requirements

Amphibians and reptiles often have highly specific food requirements. If these cannot be met, such specimens will starve. It is impossible here to detail all of the possible variations in diets for amphibians and reptiles, so again, knowing the species of your specimen and its natural habits is very important. Nace (1968) treats holding and feeding of captive amphibians thoroughly, and gives a large number of additional references on the subject. Connant (1958) and Stebbins (1966) both give valuable information on care and feeding of captive amphibians and reptiles. In addition, their books are valuable as sources of information for field studies that the amateur can conduct and are indispensable as guides for the identification and natural habits of all amphibians and reptiles found north of Mexico. They also give good lists of additional references.

Species to Keep in a Terrarium

Specimens to keep in your terrarium can be collected from the wild or purchased from local pet supply shops. If you purchase an amphibian or reptile, make sure that it is active and in good, healthy condition. Avoid animals that appear to be emaciated, since it is often impossible to get them to feed at all, once starvation has set in. You should check any turtle you purchase to make sure that its shell is hard, that the eyes are open and clear, and that it is active.

Wild specimens are almost always in better condition than pet shop stock, but it may be more difficult to start a wild specimen feeding. Particularly in snakes, there appears to be strong imprinting to specific kinds of food. When this happens, the snake may starve unless offered the type of food to which it is imprinted.

A number of amphibians and reptiles found in Manitoba make excellent terrarium specimens and are easy to keep. Following is a list of the common species of amphibians and reptiles in Manitoba.

I Amphibians

A. Salamanders

Tiger Salamander *(Ambystoma tigrinum)*

This is a large salamander from western Manitoba. It lives well in a terrarium with a pan of standing water and moist sand deep enough to burrow in. Eats earthworms readily.

Bluespotted Salamander *(Ambystoma laterale)*

A small species of salamander from the Whiteshell area. Requirements same as above, but provide stones or driftwood for the specimen to hide under. Sand should be very moist and temperture cool (65 - 70 degrees F).

Mudpuppy *(Necturus maculosus)*

Really an aquarium specimen, since it cannot leave water. Feeds readily on frozen brine shrimp, live fish, earthworms. Found in South Eastern Manitoba in streams.

B. Frogs and Toads

Chorus Frog and Spring Peeper *(Pseudacris triseriata* and *Hyla crucifer)*

Both are very small frogs. The former is found everywhere in the Province, the latter only in coniferous forest in Eastern Manitoba. Both climb well, so terrarium lid must be secure. Both feed on **small** earthworms and live insects such as fruit flies.

Grey Tree Frogs *(Hyla versicolor* and *H. chrysoscelis)*

Medium sized climbing frogs, found across most of Southern Manitoba. In the terrarium, they should be provided with branches and artificial plants for concealment and climbing. They feed readily on earthworms, mealworms and flying insects.

Common and Dakota Toads *(Bufo americanus* and *Bufo hermiophrys)*

The Common Toad is found in the coniferous forest of Eastern Manitoba, the Dakota Toad practically everywhere in the Province to the west of the coniferous forest. These are the best species for the beginner to keep in a terrarium, since they rapidly become accustomed to captivity and feed on earthworms and mealworms readily. With a bit of conditioning, they will take pieces of fish fillet held in forceps or feed from the hand. They should be provided with damp sand deep enough to excavate a burrow in.

True Frogs, Leopard Frog, Wood Frog and Mink Frog *(Rana pipiens, R. sylvatica* and *R. septentrionalis.)*

The first two are found over most of the Province, the latter in the eastern section. With the exception of the Wood Frog, these animals do not do well in the terrarium. They often refuse food to the point of starvation, and they remain nervous even after long periods in captivity. If they are kept, the Wood Frog will take mealworms and earthworms, the others, flying insects.

II Reptiles

A. Turtles

There are two species of turtles in Manitoba. The Western Painted Turtle *(Chrysemys picta belli)* is found throughout Southern Manitoba, and adapts well to a large terrarium. It should have a fairly large pan of water available and it feeds well on pieces of beef and fish. Leafy vegetables should be offered in small quantities as well. The Common Snapping Turtle *(Chelydra serpentina)*, also throughout Southern Manitoba is too large and dangerous to be used in the terrarium, except for the smallest specimens. It feeds well in captivity on almost any animal flesh, dead or alive. Large specimens are savage.

B. Snakes

Of the five species of snakes in the Province, three would be of interest to keepers of terraria. The Common and Plains Garter Snakes *(Thamnophis sirtalis* and *T. radix)* are abundant and adjust well to captivity. Natural food is frogs and some fish, but captive specimens get along well on pieces of fish fillet. The Red-bellied Snake *(Storeria occipitomaculata)* is a small species found in most of Southern Manitoba. In captivity, it feeds readily on earthworms. Since it burrows under stones and rotting wood in nature, these should be provided in the terrarium.

Observation of Terrarium Specimens

Captive amphibians and reptiles can be used in studying feeding, growth and behaviour patterns. Behaviour in these animals is almost entirely instinctive, and many species will retain their wild behaviour over long periods in captivity. Feeding and growth are poorly known for most species of amphibians and reptiles and the amateur has an opportunity to contribute useful information in this area simply by keeping accurate records.

A good food consumption and growth study requires only that the specimen be weighed and measured at capture, and at regular intervals thereafter. Food should be weighed before feeding and uneaten food recovered and weighed. With snakes and lizards, records should be kept of each moult of the skin and a pre-and-post moult weight and measurement added to the records. Further refinement of food utilization data can be gained by recovering and weighing of droppings. With lizards and snakes, this is relatively easy, since both urine and faeces are solid and dropped together. Much greater difficulty is en-

countered in amphibians, where the urine is liquid and faeces are often deposited in water.

Some of the questions you can investigate by these means are: What is the annual growth cycle of the specimen? What percentage of food intake is reflected by gain in weight? How does growth rate change as size increases? What effect does temperature have on growth?

Behaviour observations require little more than interest and patience on the part of the observer. A large number of things fall into this category, and only a few will be described here.

Breeding behaviour is easily studied with salamanders and frogs collected from breeding colonies in the early spring. (But you should also observe free animals in their natural surroundings as well). By reducing the light level, raising humidity (by means of a spray atomizer filled with water) and lowering temperature, male frogs can be induced to give mating calls.

Mated pairs of frogs can be collected from the wild and egg-laying behaviour observed in an aquarium.

Salamanders do not call, but the males have complicated courtship patterns which culminate in deposition of a spermatophore which is picked up by the female. If salamanders are collected in **very** early spring and placed in a cool aquarium in dim light and quiet surroundings, you will be able to observe the mating ritual and subsequent egg-laying by the female. Sex is easily determined in breeding salamanders by the swelling around the anus (the cloacal glands) in the males. This is not present in females.

A final aspect of behaviour that is not popularly known is the ability of amphibians and reptiles to control their body temperature. It is particularly well developed in snakes and lizards. This is easily studied by anyone willing to make or buy an electric thermometer and a switch box to handle three or more thermistors. (One for the animal's body temperature, one for air temperature, and one for soil or water temperature, at least). A small thermistor can be inserted in the anus of a specimen and held in place with adhesive tape without injuring the specimen. For the enterprising amateur, an aspirin tablet sized radio transmitter that monitors temperature and broadcasts the signal over a distance of about twelve feet can be built for about ten dollars. This can be force-fed to a snake or frog, and the signal received on an ordinary AM radio.

Measuring body temperatures will give you some interesting and surprising information. Lizards and snakes, for example, can absorb radiant heat, and their bodies will be warmer than either air or soil. Many frogs show the same relationship, but generally, a frog's body temperature is close to that of the soil or water. Air temperature seems to be the least important influence on body temperature in all cases. Observing body temperature in lizards or snakes over a few days will show that they maintain a surprisingly even body temperature that is higher than their surroundings. They do this by basking to absorb radiant heat (supplied by an incandescent lamp) and moving to shade when they have warmed up.

These are only a few things which can be learned by a study of amphibians and reptiles in terraria. With a little experience, you should be able to improve on the study methods given here and invent a host of your own questions.

A Cautionary Note

Some terrarium enthusiasts, particularly in larger cities, have bought or collected venomous snakes and kept them in their homes. This should never be attempted by amateurs because of the danger in handling such specimens and the consequences should they escape and bite someone.

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The Western Hognose Snake

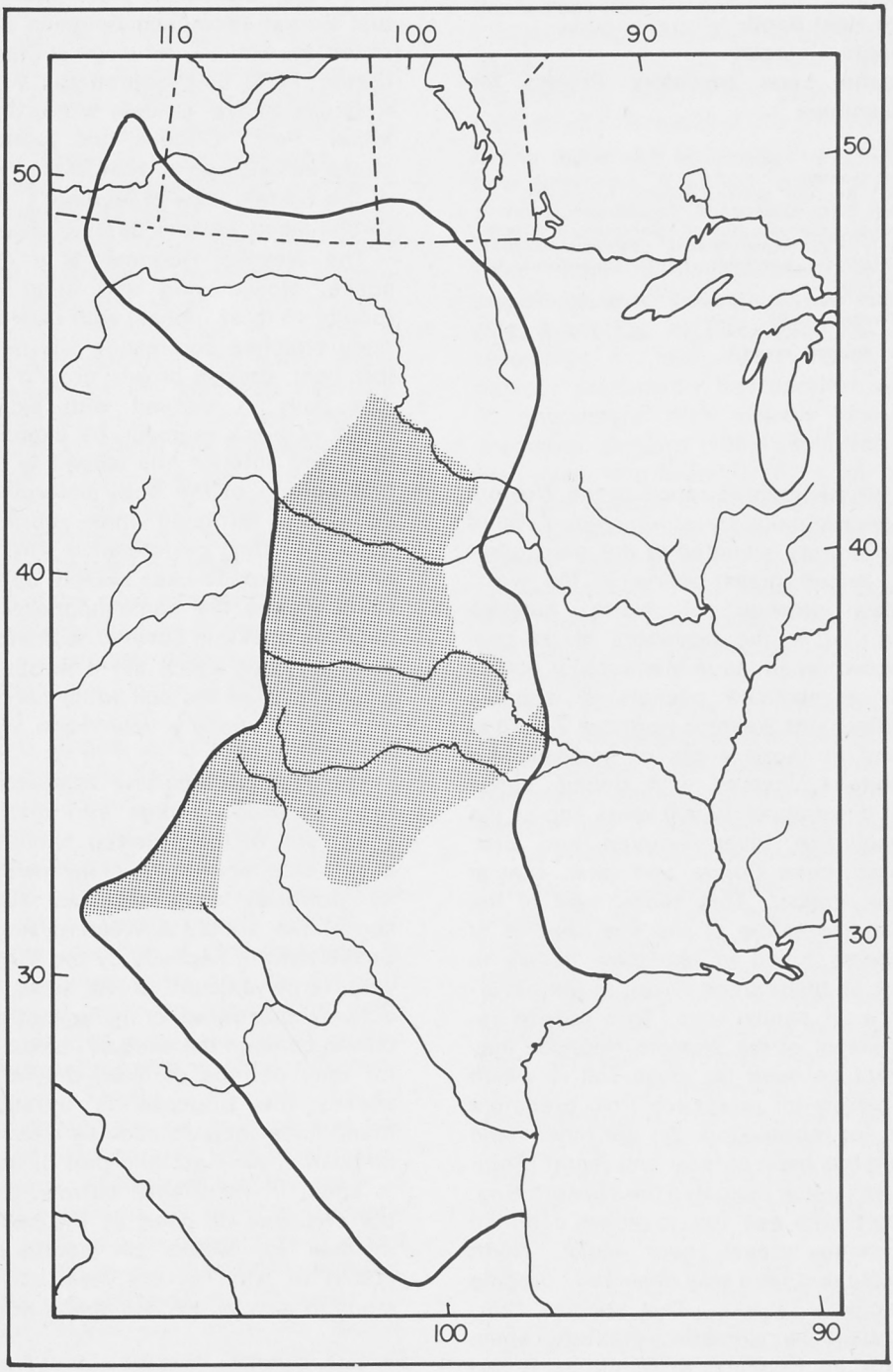

Fig. 1 Geographic range of the Western Hognose Snake *Heterodon nasicus*. The outlined area indicates the discontinuous range; the shaded area, the continuous range of the species. After Platt 1969.

Vere Hunt Scott,
Wildlife Biologist
Canada Land Inventory Project for Manitoba

Zoological classification and origin of this snake's name.
Class: Reptilia (Latin. *Repeto*, to crawl).
Order: Squamata (Latin. *Squamatus*, scaly).
Suborder: Ophidia (Greek. *Ophidion*, a serpent).
Family: Colubridae (Latin. *Colubr*, a serpent).
Subfamily: Colubrinae (Latin. *Colubrinus*, like a serpent).
Genus: *Heterodon* (Greek. *Heteros*, different; *odontos*, tooth).
Species: *nasicus* (New Latin, *nasica*, with a large or pointed nose).

The geographic range of the Western Hognose Snake (*Heterodon nasicus* Baird and Girard) is limited to the short grass and mixed grass prairie of the west-central portion of North America (Fig. 1). At the periphery of its geographic range (as in Manitoba) it occurs only in isolated pockets of suitable habitat. The Western Hognose Snake is found in those areas of southwestern Manitoba covered with deltaic sands laid down about 10,000 years ago as the Assiniboine River emptied into first, glacial Lake Souris and later, glacial Lake Agassiz. This snake, one of the most interesting of the five species of serpents found in Manitoba, seems to have its distribution linked to the occurrence of sandy soils. This habitat requirement of the Western Hognose may reflect its need for loose soil in which to burrow for protection from predators and for hibernation. On the other hand there has been at least one report (Stanley 1941) that indicated the Western Hognose Snake was "by no means confined to sandy areas" near Minot, North Dakota and here was observed "digging effectively in sod". This species characteristically inhabits relatively open, disturbed habitats. In Manitoba it has been found as far west as Oak Lake and as far east as MacGregor.

Possibly the earliest documented record of the Western Hognose Snake in Manitoba was made by pioneer Manitoba naturalist Norman Criddle. Criddle (1919) noted in the Ottawa Naturalist (now the Canadian Field Naturalist) that Ernest Thompson Seton in his list of turtles, snakes and frogs of Manitoba (Seton 1918) had omitted the Western Hognose Snake. Criddle wrote that his father, Percy Criddle, had found this snake as long ago as 1884 in the vicinity of the Criddle farm at Aweme*
(pronounced 'Aweem' by local residents)

The Western Hognose is a diurnal snake, slow-moving and stout-bodied (adults 16 to 32 inches) with dark brown body blotches contrasting sharply with the light greyish-brown ground color. The belly is marked with extensive areas of black pigment. Its expandable neck and anterior ribs spread to flatten that portion of the body enforcing the hognose's terrifying mien during its famous bluffing performance. The snout ends in a spade-like, sharply upturned scale (hence the name hognose). The hognose snake is covered with strongly keeled scales which aid it in obtaining a purchase on the soil while burrowing and give its body a very rough appearance.

The Western Hognose is specialized for burrowing. It digs into the loose sandy soil of its preferred habitat with side to side movements of its head aided by powerful neck muscles and its shovel-like snout. A Western Hognose Snake held in captivity by me spends a very large amount of its time either actively burrowing or lying motionless buried beneath the sand of its enclosure for long periods of time. Unlike other snakes the Hognose is infrequently found under objects such as rocks, logs or boards. All night and part of the day is spent in its shelter burrow. Shelter burrows may be used by the same individual for weeks or months. Platt (1969) in what is the most complete study to date of the ecology of hognose

*Aweme is a locality 5½ miles north of Treesbank, Manitoba. The place name Aweme is likely a corruption of the Cree word A-way-na, pronounced Ah-way-nah, meaning "Who is it?".

snakes found that a hognose will spend five minutes to half an hour digging a large burrow. My observations of a Western Hognose from the Bald Head Hills, Manitoba, captured in June, 1969 by Mr. and Mrs. Walter C. Richardson of Winnipeg indicate that when moulting, this snake ceases all burrowing activities. For several days before and about one day after the shedding of its skin my snake lay coiled on top of the sand in a corner of its enclosure.

Western Hognose Snakes burrow in response to low temperatures and probably hibernate in or near their home ranges. There is no evidence of a large-scale movement to and from hibernation sites (hibernacula) as occurs in spring and autumn in the garter snake populations of the Manitoba Interlake. Criddle (1937) did not find any hognose snakes in an anthill that contained large numbers of other species of snakes preparing for hibernation. Hognose snakes probably hibernate singly after digging a burrow below frost level.

One of the most interesting aspects of the Western Hognose Snake's behaviour is its stereotyped defensive behaviour. The sequence begins as the snake, confronted by a man, fills its lungs with air and hisses, alternately expanding and contracting its body. The hissing is continued during both inhalation and exhalation. The head and neck are spread, the body coiled and often with staccato puffs of air the hognose lashes out with its head (mouth closed) to bunt the offender. If this ruse fails to deter the investigator and the snake is touched, it goes into convulsions, defecates, writhes about, its mouth agape (its mucous membrane often auto-hemorrhaging). Finally to complete the act the hognose rolls on its back and lies still and limp covered with fecal matter and blood. At this point, if the snake is turned over onto its belly, it promptly turns back onto its dorsal side. If poked it may respond with brief writhing. Should the observer remain quiet the "dead" snake will close its mouth, turn its head over and begin to flick its tongue. It slowly begins to right its body and move off. Movement on the part of the spectator at this time will cause the snake to turn belly up and open its mouth again. Munyer (1967) suggested that the belly-up position may have evolved for use as a ruse in water where, he observed, a truly dead snake floats belly up.

Platt (1969) noted that the stereotyped death-feigning is less well-developed in the Western than in the Eastern Hognose Snake (*Heterodon platyrhinos*). My snake never did feign death no matter how provoked. It coiled, with its body in the form of a "C", hissed and made pseudo-strikes. However, if further irritated, rather than feign death, it concealed its head beneath its coiled tail (Fig. 3 and Fig. 4). The coiled tail thus resembles a "false head". Such behaviour presumably has survival value in encounters with visually oriented predators. Bustard (1969) feels that the "tail-mimicking-head" trait is an evolutionary prelude to the defensive "balling" behaviour of some snakes (e.g. Pacific Boa, *Candoia aspera*). These snakes protect their head by coiling their body tightly about it to form a ball which can actually be rolled on a flat surface.

After six months in captivity my Western Hognose Snake, which has been little handled, still exhibits with undiminished intensity all the bluffing behaviour that it did when first captured.

The Western Hognose Snake exhibits a fondness for amphibians, particularly toads, and for lizards and lizard eggs. Hognose snakes have a physiological resistance to the toxic secretions of toads (Smith and White 1955). In Manitoba the Western Hognose would be expected to prey on the Northern Prairie Skink (*Eumeces septentrionalis*) and the Plains Spadefoot Toad (*Scaphiopus bombifrons*) which share portions of its isolated range. My captive specimen from the Bald Head Hills has eaten Manitoba Toads (*Bufo hemiophrys*), Wood Frogs (*Rana sylvatica*) and Gray Tree Frogs (*Hyla versicolor*). Other food items recorded for the Western Hognose are Leopard Frogs, Short-tailed Shrew, Grasshopper Sparrow, dead rats and mice (in captivity) and garter snakes.

Vere Hunt Scott, 1969 (All photos)

Fig.3.
Western Hognose Snake from Manitoba about to conceal its head beneath its coils. At this stage it will still pseudo strike and is still hissing.
Note the characteristic "C" form in which the body is held.

Fig. 4.
Head concealed. Coiled tail held up in an exposed, erect manner, mimicking a head.

Fig. 2.
Western Hognose Snake from Manitoba. Note the stout body, wide neck and dark (brown) body blotches.

Platt (1969) believes the hognose snake's two enlarged posterior teeth are not so much an adaptation for deflating toads (which inflate their lungs when attacked by a snake to make swallowing difficult) as a method for holding struggling prey more effectively. It is from these relatively large rear teeth that the hognose snake got its generic name *Heterodon* or "different-toothed".

The courtship and breeding behaviour of the Western Hognose Snake has yet to be observed. The principal mating period is in the spring. They are relatively inactive in the autumn and mating at this time is probably not common. Males are sexually mature at one year but the females not until two or three years of age (Platt 1969).

The Western Hognose Snake lays white, elliptical eggs. Natural nests of the Western Hognose have not been described. Platt records Ian L. Traill's observations of a Western Hognose Snake from Shilo, Manitoba that laid a clutch of 12 eggs between June 12 and 17. All 12 eggs subsequently hatched on August 2, giving an incubation period of between 47 and 52 days.

The natural history of the Western Hognose Snake in Manitoba is virtually unstudied. It is hoped that the continuing recreational development of Spruce Woods Provincial Park, in the heart of this fascinating snake's Manitoba range does not lead to destruction of its habitat or to annihilation of its populations through ignorant persecution. The time must soon come when Manitobans recognize the aesthetic value and rightful position in our fauna of reptiles such as the hognose snake. Our provincial Wildlife Act is embarrassingly incomplete when we realize that nowhere in its pages are reptiles or amphibians recognized as wildlife. These two classes of vertebrates remain in a limbo — unrecognized by wildlife biologists and treated as poor cousins by fisheries biologists. It behooves us as responsible Canadians not to let this herpetofauna vanish as we have allowed the once vast prairie to fall under the treads of civilization. The reptiles and amphibians are as much a part of the Manitoba prairie as were the Kit Fox, the Pronghorn and the Bison.

I wish to thank the following persons: Mr. Francis R. Cook and Dr. K. W. Stewart, Department of Zoology, University of Manitoba for their discussions with me concerning the ecology of the Western Hognose Snake in Manitoba; Mr. David R. M. Hatch, F.R.E.D. Program, Manitoba Department of Mines and Natural Resources for western locality records; Mr. David Nanowin, teacher of the Cree language at the Indian and Metis Friendship Centre, Winnipeg and Mr. J. Nepinak, Conservation Extension, Manitoba Department of Mines and Natural Resources for aid with the Cree language; Mr. Ed Arnold, draftsman, Canada Land Inventory Project for Manitoba for the range map; and Carol A. McGrath for aid in searching the literature and for helpful suggestions in reviewing the manuscript.

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"The Zoo of the Future" Dr. Gunter Voss

Few are the events when a zoo man who has been in the profession for twenty-eight years returns from a conference truly enriched and inspired. The symposium on "The Zoo of the Future" was one of them.*

The Metropolitan Corporation of Greater Winnipeg allowed me time off to attend. I had the honour of serving on the various panels. Mr. George B. Bartholick acted as the general moderator. He is the gentleman charged with the design of suitable wild animal environments under human management in the Washington State area. Specifically, this may mean the rebuilding of Woodland Park Zoo of the City of Seattle and the creation of a rare animal breeding centre in the near-desert area of the interior of the State of Washington, but it could also mean the design of entirely new institutions. Mr. Bartholick attended every session with his charming wife and his dedicated team. All of us zoo heads were tremendously impressed by the intelligent, searching questions Mr. Bartholick asked us and by his and his team's honest desire to listen and to learn.

From as far away as Zululand, Natal, Republic of South Africa, the Chief Conservation Officer, Ian C. Player had come. From Britain, Reginald Bloom, General Curator of the Windsor Lion Safari Zoo and famous Jimmy Chipperfield attended. While his brother controls the circus enterprise, Jimmy runs one Lion Safari institution each in Australia, Canada, England and Holland, has another four in various stages of development — two in England, one in Germany and one in Scotland — and a further two planned. Lutz Ruhe had come from Oakland, California, where he owns a private zoo. His brother Hermann, with animal importation headquarters still at Alfeld, West Germany, controls four zoological parks; the traditional zoos of Hannover and Gelsenkirchen in Germany, a drive-through zoo at Thoiry near Paris and another one on Mallorca, a Spanish island in the western Mediterranean.

A goodly number of architects, engineers and landscape architects had been attracted to the symposium and groups which might well be termed surprise groups even to the zoo buff. I want to single out the energetic men from Spokane, Wash. who had formed a zoo society and had begun zoo planning with emphasis on thoroughness and good taste. They showed slides of a site, available for zoo development east of Spokane, so beautiful that its beauty should dictate the type of development.

Zoo and aquarium folks in the Northwestern United States boast of a very fortunate situation, namely that the aquarium and zoo societies of Portland, Tacoma, Seattle, Vancouver and Spokane are all friendly and helpful with each other. Further, the populations of major cities favour zoological developments, as demonstrated by the large support for "forward thrust" bond moneys. So there is a most encouraging climate in these respects.

Great zoological parks, once a status symbol of royalty, have become status symbols of communities.

Municipal councils will probably insist on the traditional, "well-rounded" zoo animal collection, but entrepeneur, society-controlled and hobbyists' institutions would be wise to advertise themselves by their specialties. The call was often heard: Specialize, settle for a smaller mission. Use museum techniques to an advantage to tell the animals' story. Specialization need not mean restriction; not impoverishment, but possibly expansion, most surely enrichment. Zoos and aquariums should have firm, indisputable answers as to why they obtain certain animal species and should not lamely reply that they "were available".

It is better to run a small institution of high quality than a shoddy, big one. It's excellence that brings your visitors back.

Why zoos? As well as natural history museums, zoos have a cultural mission. They allow us to study ourselves

as we study animal behaviour. They teach man, through animals, to begin to understand himself.

To emphasize the dignity of the animals in all exhibits, is of basic importance. It is the principal failure of shows in carnival style that they take away just that.

A discussion ensued on mechanical rides. The panel leader summarized what had been expressed, in these remarks: "What kind of experience do we want to give our visitors? AN ISLAND OF SANITY IN A CRAZY WORLD! How much do they absorb driving; how much walking? And what is better? I question the aesthetics. Have we set out to run a carnival?" Quiet boat rides and transportation using ponies, llamas and camels were favoured, however.

In just about every zoo, losses of animal life have occurred from feeding by the public. The need was expressed for a sign without text, a symbol-type sign which would be internationally understood to express "Do not feed the zoo animals".

Another sign of this style should be internationally developed that would say "Do not litter".

The need for better cooperation from highway departments was strongly felt to mark exits to zoos and aquariums from interstate, national and state/-provincial routes. Again a generally understandable symbol might serve usefully.

People must come in fair numbers so that there be funds to run the aquarium or zoo. Dr. Charles R. Schroeder, Director of the San Diego Zoo, the biggest wild animal exhibition anywhere, presented some impressive facts. More than three million people come to visit his zoo per annum. Membership in the San Diego Zoological Society stands at 21,000. Through the last five years, the operating budget has risen 10 to 12% annually. More attractions, bringing more visitors, must make up for it. Visitors to the San Diego Zoo stayed an average of two hours ten years ago; now they stay for three and a half hours. The Zoological Society operates the zoo in its entirety; there are no concessions. There is no depreciation account in the zoo budget.

The San Diego Zoological Society is in the process of developing a huge zoological park for the exhibit of herd animals in large paddocks. This new enterprise, located in the San Pasquale valley near the city limits of San Diego, is estimated to cost ten million dollars and is scheduled to open to the public in January of 1972. It will provide 10,000 car parking lots.

Another major American zoo mentioned an example to illustrate the importance of internal auditing. Customarily the operator of the balloon concession had been granted an allowance of 35% for breakage. The new zoo director had this situation checked and found the figure to be far from real. He dismissed the operator, and the new one gets along fine with a breakage rate of 5%.

At the same zoo, marshmallows and plastic bags were thrown into the polar bear moat in such vast quantities that they entirely blocked all outlets. The moat filled with water overnight. The polar bears comfortably swam across and walked over the zoo. Marshmallow sales were halted because the loss of $20,000 (twenty thousand dollars) in revenue hurts less than to have polar bears wander free.

Every car that enters the grounds at Jimmy Chipperfield's Lion Safari animal park at Rockton, Ontario, Canada, is charged an even four dollars. Visitors who desire to go on a boat ride pay for that separately, and the ones who wish to stroll through the petting zoo pay once again. Zoological gardens that want to attain some degree of independence from politically controlled budget strings will take notice. The quibbling over dimes and quarters when it concerns zoo admission charges, is bound to appear outdated before too long. Why continue to struggle whether certain low income groups should have free or reduced admission fees? Why continue to tempt youngsters to tell the cashier a lie about their age? Why have angry waiting queues at the cash-

ier's booth? All of this can be done away with when a nice, round charge is made per car. (And unaccompanied youngsters are denied admittance.) There need not be a waiting line of cars either. You sell your parking tags for the day at one, two or three convenient locations inside the zoo, and no car driver is let out who hasn't bought one.

Per capita standing figures were presented. Every person entering Disneyland leaves $10.00 behind; every one visiting Marineland of the Pacific leaves $7.50; at San Diego zoo the figure is $2.10 and at Cleveland zoo $ .94.

"But when it comes to financing research and educational programs in zoos," Dr. Crowcroft of Brookfield zoo remarked with a sigh, "our handicap is cultural inertia. Unless," he added, "you sell immortality in the form of scientific publications with the sponsor's name on the outside."

Chief Conservator Ian C. Player appealed to all zoological societies to assist international wildlife conservation. In no way could they do this better, he said, than through guided tours to game reserves overseas.

With a potpourri of slides, taken in a multitude of zoos in a variety of countries and continents, Mr. George B. Bartholick started the first session on the evening of our arrival. The slides followed upon each other so rapidly that the effect was somewhere between a movie and psychedelic showing. But the message was clearly noted — that our symposium was to cover every conceivable aspect of zoo design and operation that could possibly be squeezed into the few days of the symposium. Questions of very real concern arose right in the first session. Can you safely use overflow water from one animal enclosure in another one? Is there such a thing as truly good artificial rockwork? How do you close off an animal domain valley that experiences a flood every year? Some of these questions and a few more, I am ashamed to admit, remained unanswered when the symposium ended.

But whenever we dealt with the subject of zoo design in a stricter sense, a few essential rules emerged time and again. A really good zoo animal habitat can only be developed by or in very intensive cooperation with an experienced zoo biologist. No one else is capable of providing the basic needs for the animals' physical and mental health, for their privacy and their readiness to reproduce. If in addition, a keen sense of good taste prevails, such a zoo is bound to become outstanding, whether it be large or small. What matters is the right balance of practicality and beauty or, in other terms, of efficiency and taste. The able guidance by a zoo biologist and the decision-making by him are of utmost importance.

The San Diego zoo designer spoke of the desirability of a quiet transition area between the car park and the first major animal exhibit. If this highly recommendable zone could become educational, for instance through effective ways of exhibiting microscopic life, an "introduction to life" theme would condition zoo visitors for the experience awaiting them. Possibilities along these lines have, as yet, not been utilized at all.

So it went on from session to session: New questions, new thoughts, new prospects. The exchange of ideas went right on in the few minutes between sessions and deep into the nights. Upon asking, I received two excellent suggestions as to the most unobtrusive ways of confining elephants. I simply cannot picture an intelligent person who did not leave this symposium enriched.

Some proposals heard are, by necessity, unobtainable for the individual zoo man at his place of work; the reasons may be funding, climate or other ones. I was blessed to be led down to earth by a very fine experience in Vancouver harbour between flights, when I had the pleasure of seeing off some surplus specimens from our zoo in Winnipeg — a gibbon, collared peccaries, cinnamon bears and Canadian porcupines — aboard the motor vessel "Crusader", destined for a zoo in New Zealand.

*ORGANIZED BY The Seattle Zoological Society
HELD at Alderbrook Inn on Hood Canal, Puget Sound, from 16 to 18 January, 1970.

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We take a lot of things for granted in this world of ours. Things that are so much a part of everyday life that we don't really think about them until they're suddenly not there. Then we realize just how important they are. Take electricity for example. It's always there when we want it. We don't stop to think about what electricity means to us. It means a warm house in the morning, it means a comforting light on a darkened street, it means hot toast and bacon and eggs right off the griddle, it means music, entertainment and a lot less work when things have to be done. And even during those rare occasions when something stops the electricity from getting to us, to feed us and warm us, and light our way, we still take it for granted. It'll be back on in a few minutes. Back on because hard working dedicated men put all their efforts into making sure that you can go on . . . taking us for granted.

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